NALAIYA THIRAN

APPLIED DATA SCIENCE

SMART LENDER - APPLICANT CREDIBILITY PREDICTION FOR LOAN APPROVAL

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in the partial fulfillment of the award of the degree

of

BACHELOR OF TECHNOLOGY

in

INFORMATION TECHNOLOGY

ANNA UNIVERSITY , CEG

Chennai - 25

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1. INTRODUCTION

1.1 Project Overview

The SmartLender is an application that enables loan lenders to decide if a borrower is credible to repay the money borrowed or not. A loan borrower can make use of this application to get to know about the maximum amount of money he or she can borrow based on his or her income details.

1.2 Purpose

The loan borrowers at times don't repay the loan back on time. At times, they are clever enough to cheat without paying back the loan. This makes the loan lenders skeptical. Even if the loan borrowers provide legit information, it becomes a tedious task for the lender to manually verify the details provided especially when the lender lends to multiple borrowers. Thereby, it becomes essential to have an automated system that enables swift prediction to check the credibility of the borrower.

2. LITERATURE SURVEY

2.1 Existing problem

This project focuses on two customers namely, the lender and the borrower. The lender might sometimes plan on providing loans to multiple borrowers. He might find it difficult to manually go through their details to access the credibility of the borrowers. The individual may not be aware of the maximum borrowable amount whenever his loan request for an amount exceeding his capacity is requested for. The borrower might sometimes wish to know about the maximum loan amount he can get using his income before he applies for the loan. These are some of the commonly existing problems.

2.2 References

The following papers were referred to for the purpose of developing an automated system to benefit the lenders and the borrowers.

- Machine Learning Based Model for Prediction of Loan Approval [1] by B. P. Lohani, M. Trivedi, R. J. Singh, V. Bibhu, S. Ranjan, and P. K. Kushwaha, makes use of applied logistic regression to predict if a person is eligible for a loan or not.
- Loan Approval Prediction [2] by Shubham Nalawade, Suraj Andhe, Siddhesh Parab, Prof. Amruta Sankhe compares the accuracy of different machine learning algorithms

used for the prediction of loan and concluded that logistic regression provided the best accuracy of 88.70%.

- Subhiksha R, Vaishnavi L, Shalini B, and Mr. N. Manikandan in their paper [3] "Bank Loan Approval Prediction Using Data Science Technique (ML)" have used four algorithms namely random forest algorithm, decision tree algorithm, Naive Bayes algorithm, logistic regression algorithm for the purpose of predict loan for customers. All these algorithms were used on the same data set for determining the model with maximum accuracy.
- Soni P M, Varghese Paul in their work [4] Algorithm For the Loan Credibility Prediction System, have used the fisher score and a wrapper model to convey that the new hybrid model produces better accuracy when compared to traditional models.
- An Approach for Prediction of Loan Approval using Machine Learning Algorithm [5] by M. A. Sheikh, A. K. Goel, and T. Kumar have considered different measures of performances computed using logistic regression.

2.3 Problem Statement Definition

One of the challenging challenges for every bank is the prediction of credit defaulters. However, by predicting the loan defaulters, the banks will undoubtedly be able to cut their loss by decreasing their non-profit assets, allowing for the loss-free recovery of sanctioned loans, which can act as a contributing factor to the bank statement. This highlights the significance of studying this loan approval forecast. The prediction of this kind of data makes use of machine learning techniques, which are both essential and valuable.

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas

- An empathy map is a straightforward, simple-to-understand picture that summarizes information about a user's actions and views.
- Teams can utilize an empathy map as a collaborative tool to obtain a deeper understanding of their customer.
- An empathy map is a popular visualization tool in the UX and HCI fields of practice.
- An empathy map's main objective in empathetic design is to bridge the understanding of the end user.

- A rectangle divided into four quadrants, with the user or client in the center, is an empathy map. A category is included in each of the four quadrants to assist us in better understanding the user's perspective.
- The four empathy map quadrants examine the user's actions, thoughts, and feelings.

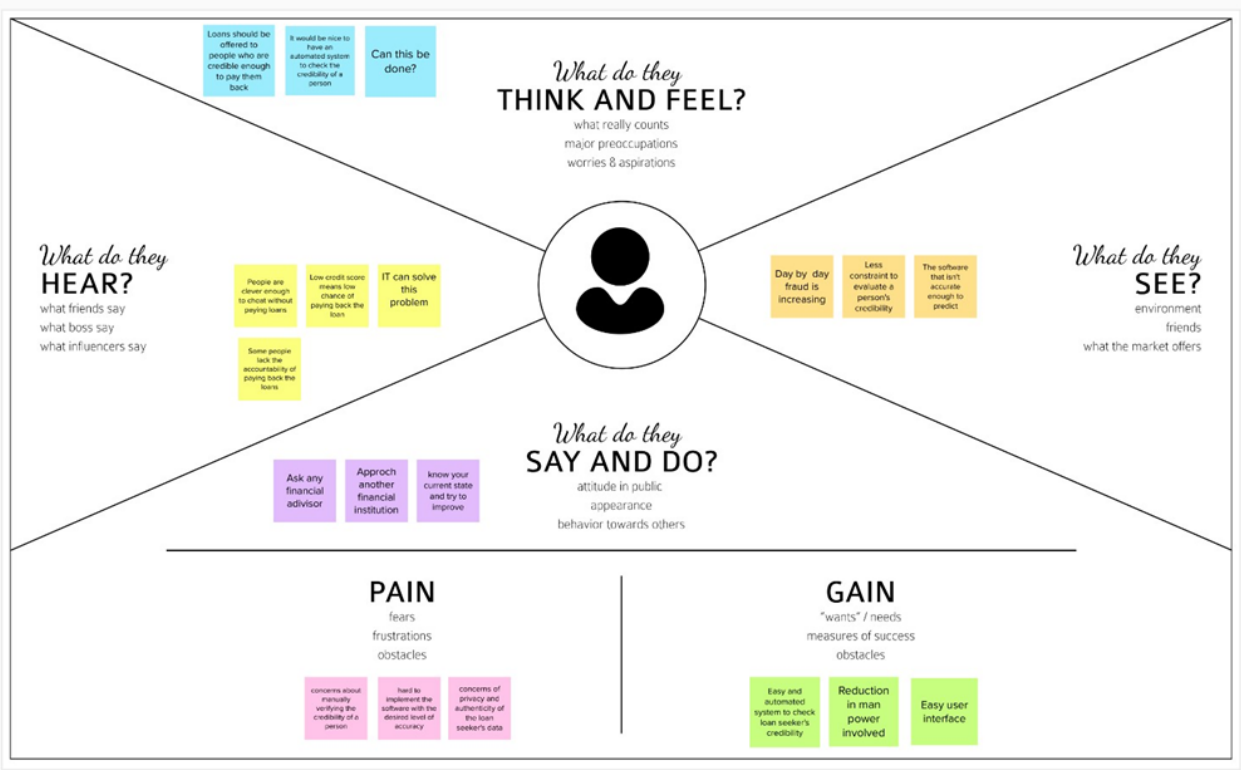

Figure 3.1 Empathy Map

From the empathy map we can infer about customer's thought about loan credibility like they feel that it would be good to have an automated system to check for the borrower's credibility.Moreover loan should be given only to the persons who will be able to repay the loan. Without an automated system it would be difficult for them to manually verify the credibility and if an automated system is present it would reduce the man power and time needed to complete the task.

3.2 Ideation & Brainstorming

The following diagram 3.2 a illustrates the brainstorming done for the smart lender system

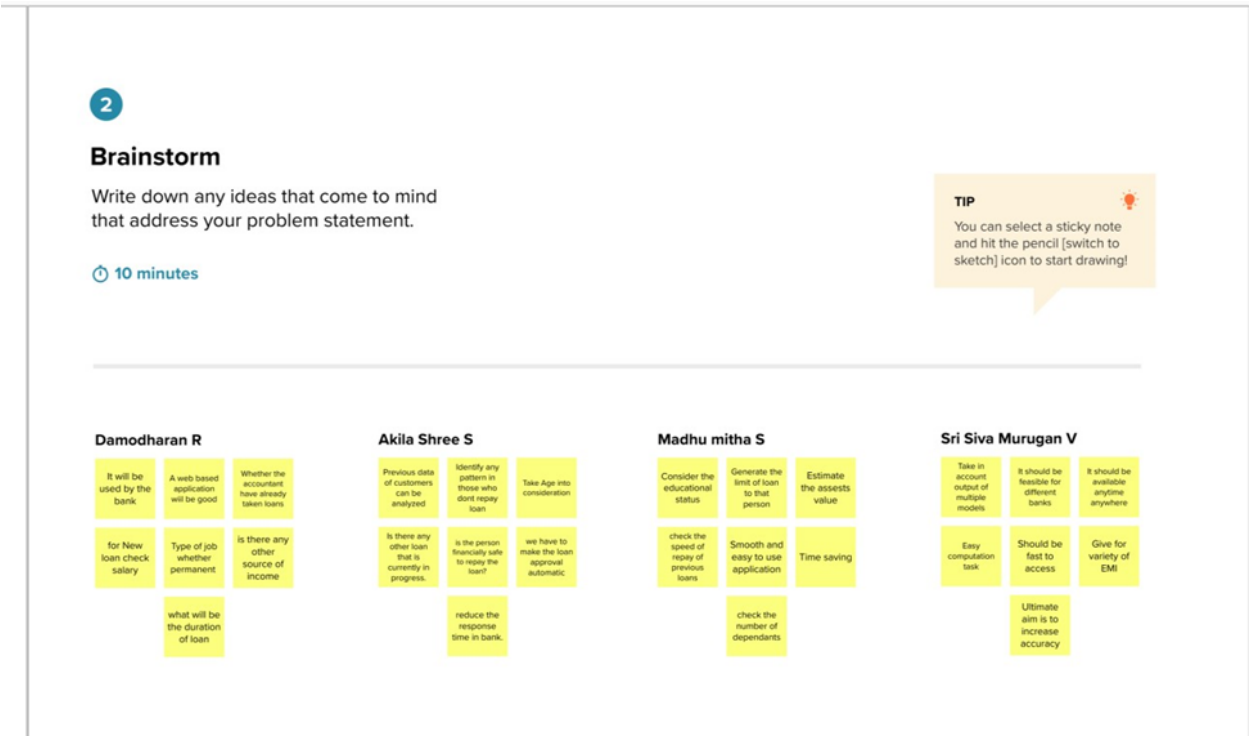

Figure 3.2 a Ideation & Brainstorming

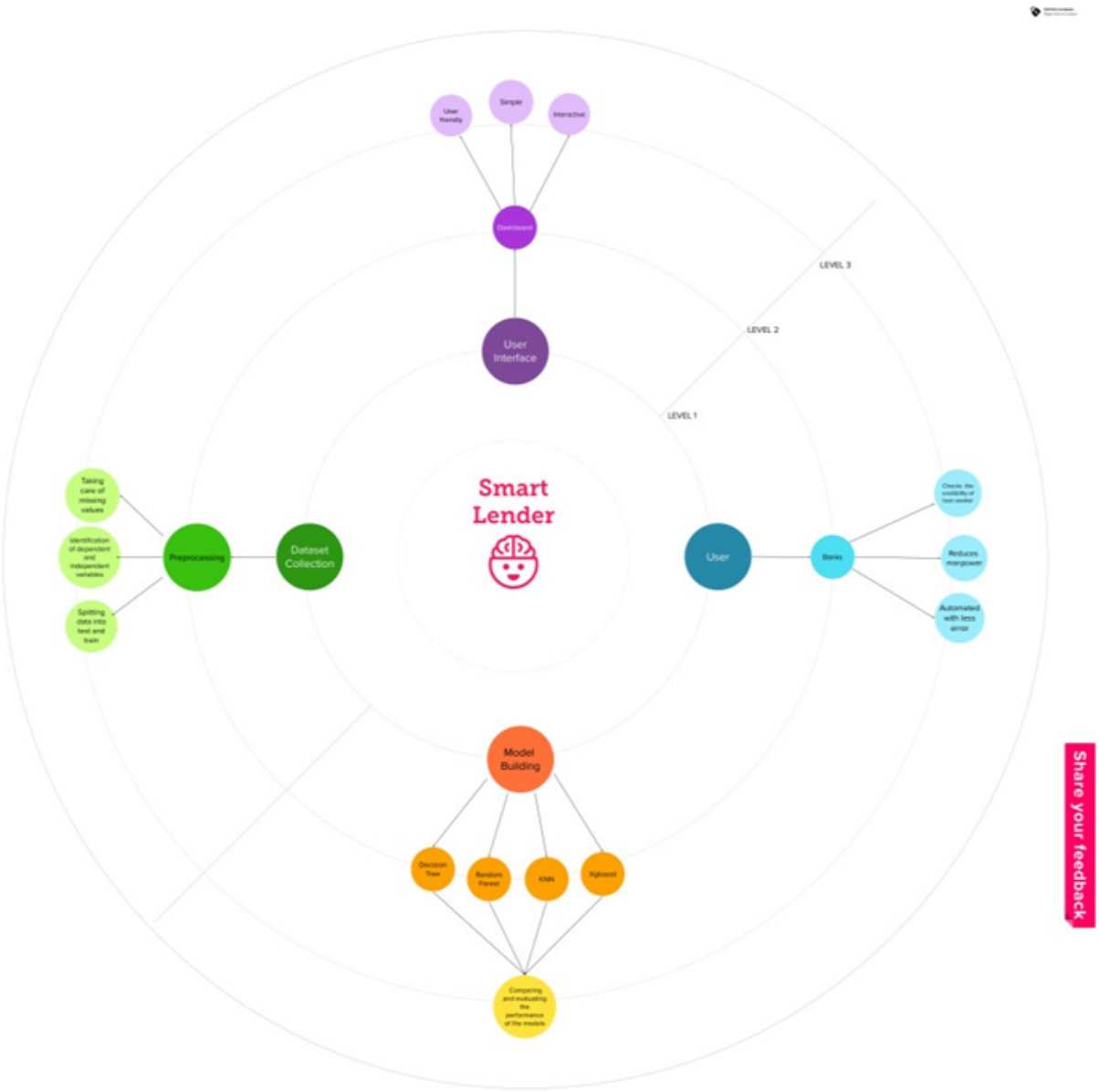

Figure 3.2 b Ideation & Brainstorming

Some of the highlights of Ideation and Brainstorming are:

Collecting dataset with necessary attributes for prediction of loan approval.

Building model using the dataset for prediction.

Creating an user interface for the users.

3.3 Proposed Solution

Problem Statement (Problem to be solved):

To help loan lenders to check the eligibility of a loan applicant, in order to avoid the potential risk of loan defaulting.

Idea / Solution description :

Creating web application to collect various parameters like income, credit score, etc. and using several machine learning models to predict the possibility of loan approval (for Personal loan and vehicle loan).

Novelty / Uniqueness:

Existing solutions propose the eligibility of an applicant alone, while this solution aims to predict the approvable amount and duration in months in case if the application fails to meet the criteria, along with the eligibility prediction.

Social Impact / Customer Satisfaction :

Helps the stakeholders (lenders / borrowers) to easily check the eligibility for loan approval.

Business Model (Revenue Model):

A high-traffic website that would generate revenue from displaying advertisements.

Scalability of the Solution:

It can be extended to other types of loan. Aadhar and pan verification can also be included.

3.4 Problem Solution fit

The following diagram 3.4 a illustrates the Solution Fit.

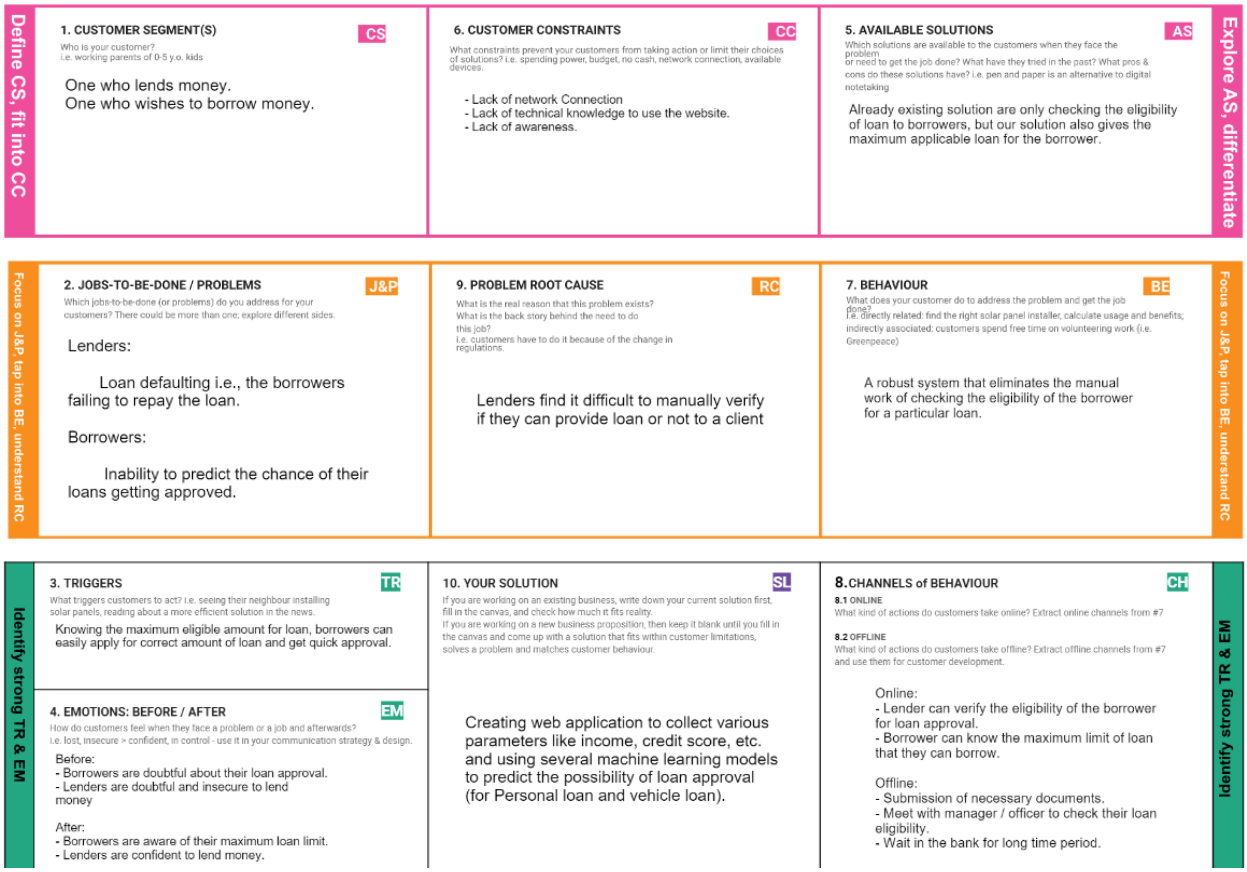

Figure 3.4 Solution Fit

4. REQUIREMENT ANALYSIS

4.1 Functional requirement

Following are the functional requirements of the proposed solution.

4.1 a) User Input

The user should select the type of loan and fill in the necessary details.

4.1 b) Eligibility of Loan

The loan can either be approved or rejected.

4.1 c) Check for the approvable amount of the loan

If the loan is rejected then the user can know their approvable amount.

4.1 d) Chatbot

The Chatbot clarifies on user's basic doubts.

4.2 Non-Functional requirements

The following are non-functional requirements that are essential.

4.2 a) Usability

The system ensures intuitiveness in the user by providing an easy-to-use and self-explainable website. The site allows users to navigate between pages. The website also has a simple structure thereby enabling faster access.

4.2 b) Reliability

The results produced are obtained from ensembling the outputs of various machine learning models. Thereby the system is highly reliable.

4.2 c) Performance

The proposed web-based application has the ability to indicate if the user inputs erroneous data types.

4.2 d) Availability

A simple web browser is enough to access the website.

4.2 e) Scalability

The site can be extended for other types of loans and user details verification by means of aadhar and PANcards can also be implemented.

5. PROJECT DESIGN

5.1 Data Flow Diagrams

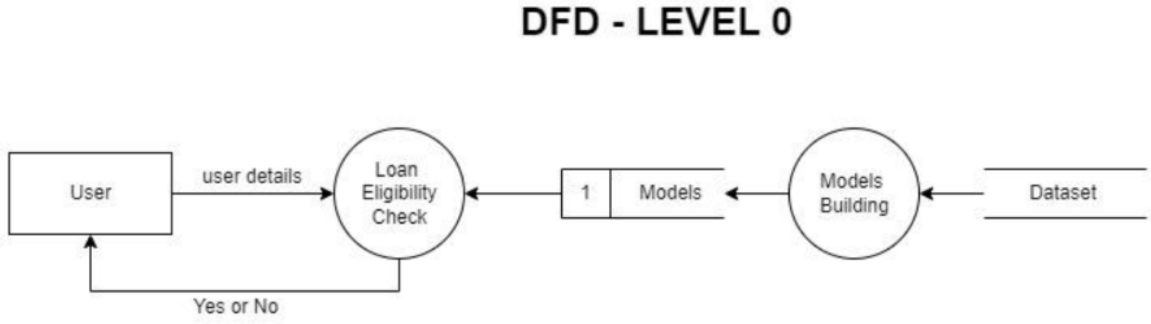

Figure 5.1 Data Flow Diagram - Level 0

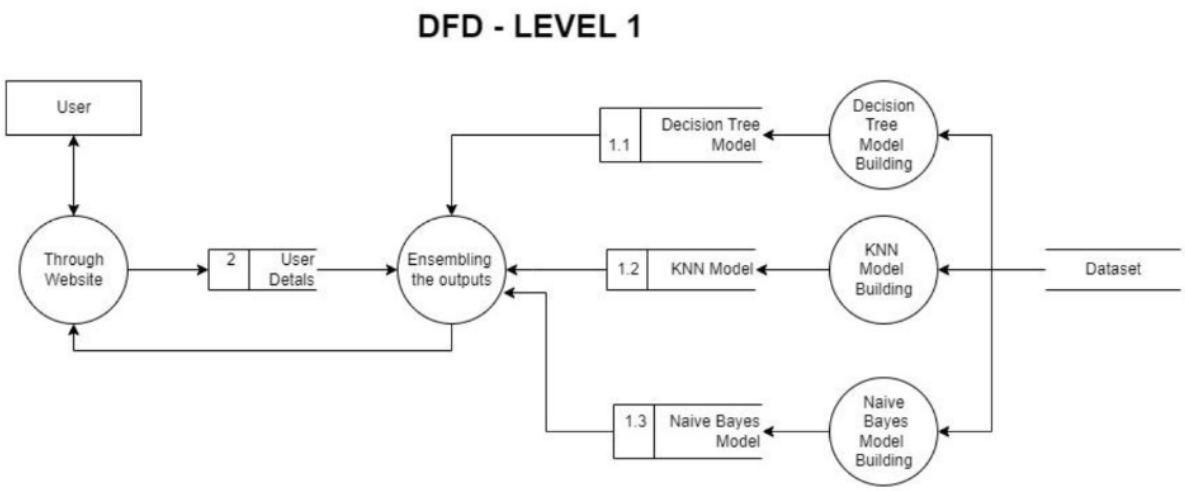

Figure 5.2 Data Flow Diagram - Level 1

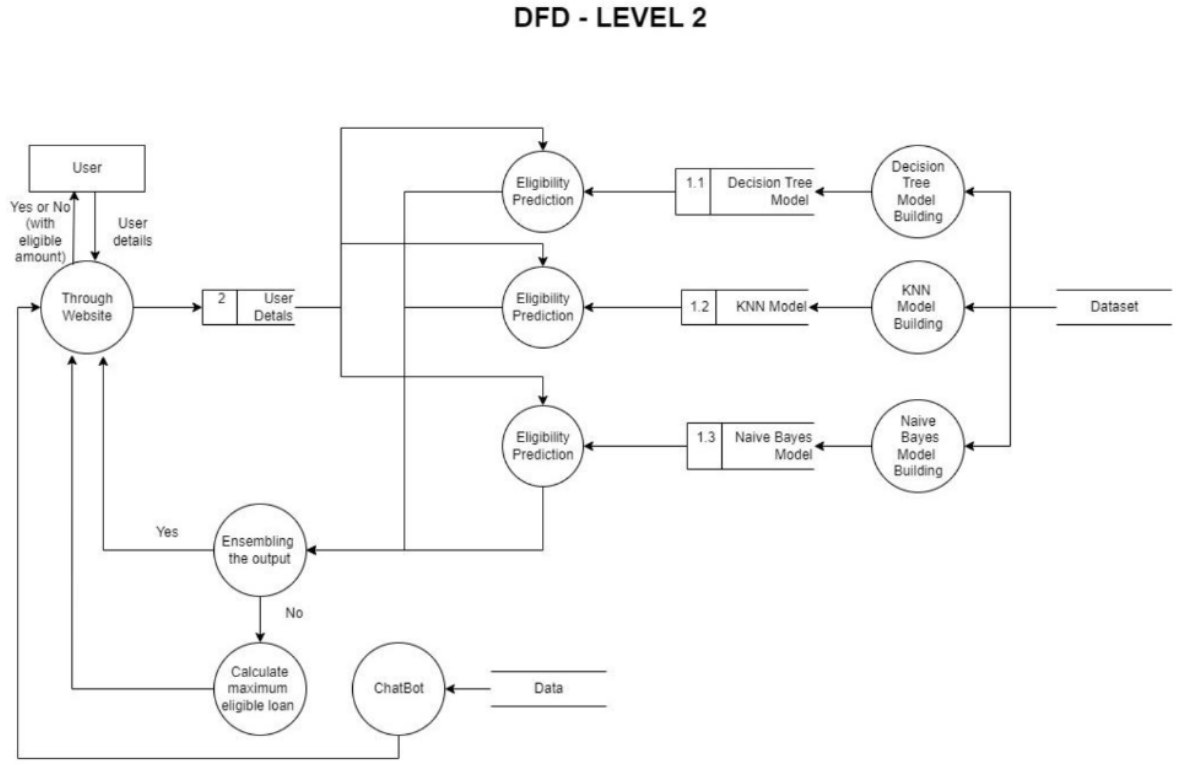

Figure 5.3 Data Flow Diagram - Level 2

5.2 Solution & Technical Architecture

The following diagram 5.4 shows the technical architecture of the system.

Technical Architecture:

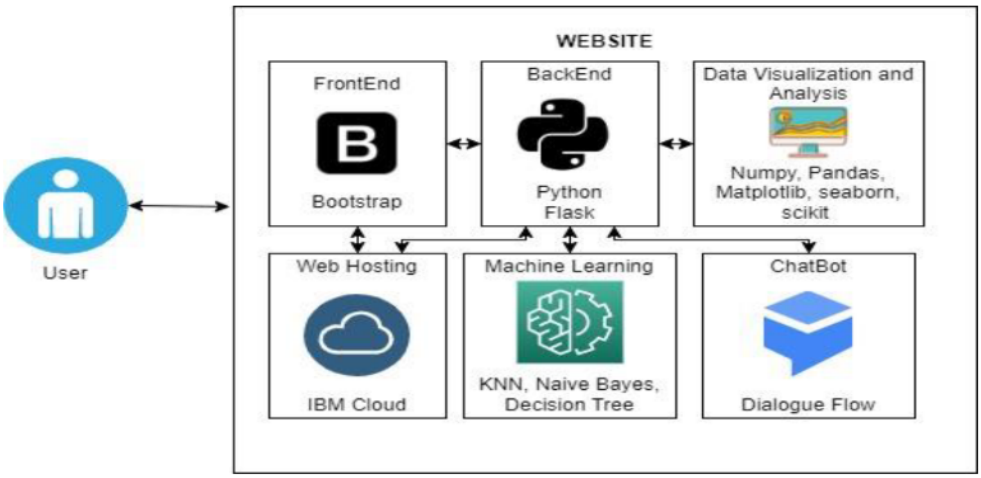

Figure 5.4 Technical Architecture

5.3 User Stories

User Story-1 (USN-1):

The type of user here is the money lender who wishes to access the dashboard using the proposed web application. Thereby, the functional requirement here is the dashboard and the acceptance criteria are to access the dashboard. The assigned priority here is low and it is planned to be released during sprint 3.

User Story-2 (USN-2):

The type of user here is the money lender who wishes to select the type of loan from the options available using the proposed web application. The acceptance criteria here enable the users to select the type of loan. The priority assigned is medium and it is scheduled to be released during sprint 3.

User Story-3 (USN-3):

The type of user here is the money lender who wishes to fill in the borrower details making use of the interface provided by the proposed web application. The functional requirement here is thereby to check the eligibility of the borrower. This task is assigned with high priority and is scheduled to be released in sprint 3.

User Story-4 (USN-4):

The type of user here is the money borrower who wishes to access the dashboard using the proposed website. The functional requirement here is the dashboard and the

assigned priority is low. The acceptance criteria are access to the dashboard and it is planned to be released during sprint 3.

User Story-5 (USN-5):

The type of user here is the money borrower who wishes to choose the type of loan using the proposed website. The priority assigned here is medium. This task is planned to be released during sprint 4.

User Story-6 (USN-6):

The borrower wishes to fill in the details mentioned in the interface in order to check if the loan will be approved or not. This task is assigned high priority and it is scheduled to be released during sprint-4.

User Story-7 (USN-7):

The borrower wishes to use the chatbot integrated into the website and clarify his doubts. This task is assigned medium priority. The functional requirement is a chatbot and it is scheduled to be released during sprint-4.

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

The following table 6.1 gives the sprint planning.

Sprint	**Functional Requirement (Epic)**	**User Story Number**	**User Story / Task**	**Story Points**	**Priority**
Sprint-1	Dataset	USN-4	Downloading the dataset	1	High

Sprint-1		USN-5	Visualizing the dataset	2	Low
Sprint-1		USN-6	Pre-process the dataset	3	Medium
Sprint-1	Machine Learning Model	USN-7	KNN model building	5	High
Sprint-2		USN-8	Decision Tree model building	5	High
Sprint-2		USN-9	Naive Bayes model building	5	High
Sprint-2		USN-10	Fine Tuning the model	3	Low
Sprint-2		USN-11	Evaluation and saving of the models	5	High

Sprint-3	Customer User Interface	USN-12	Model Integration with flask	5	High
Sprint-3		USN-1	As a user, I should be able to access the dashboard.	3	Medium
Sprint-3		USN-2	Select the type of loan	3	Low
Sprint-3		USN-3	Fill the application and check the eligibility of loan approval	5	High
Sprint-4	Deployed the website	USN-13	Register on IBM Cloud	3	Low
Sprint-4		USN-14	Train the ML model on IBM Cloud	5	Medium
Sprint-4		USN-15	Deploy the website on IBM Cloud	8	High

Table 6.1 Sprint Planning

6.2 Sprint Delivery Schedule

The following table 6.2 gives the sprint delivery schedule.

Sprint	**Total Story Points**	**Duration**	**Sprint Start Date**	**Sprint End Date (Planned)**	**Story Points Completed (as on Planned End Date)**	**Sprint Release Date (Actual)**
Sprint-1	11	6 Days	24 Oct 2022	29 Oct 2022	11	29 Oct 2022
Sprint-2	18	6 Days	31 Oct 2022	05 Nov 2022	18	05 Nov 2022
Sprint-3	16	6 Days	07 Nov 2022	12 Nov 2022	16	12 Nov 2022
Sprint-4	16	6 Days	14 Nov 2022	19 Nov 2022	16	19 Nov 2022

Table 6.2 Sprint Delivery Schedule

6.3 Reports from JIRA

JIRA Tool was used for project monitoring and management.The tasks for the project had been defined and divided into four sprints . The storypoints and priority for each task is assigned.The start and end time for each sprint is added. Once the task is started it will be in progress state. After it is completed it will be in review state. Similarly all the four sprints had been completed.

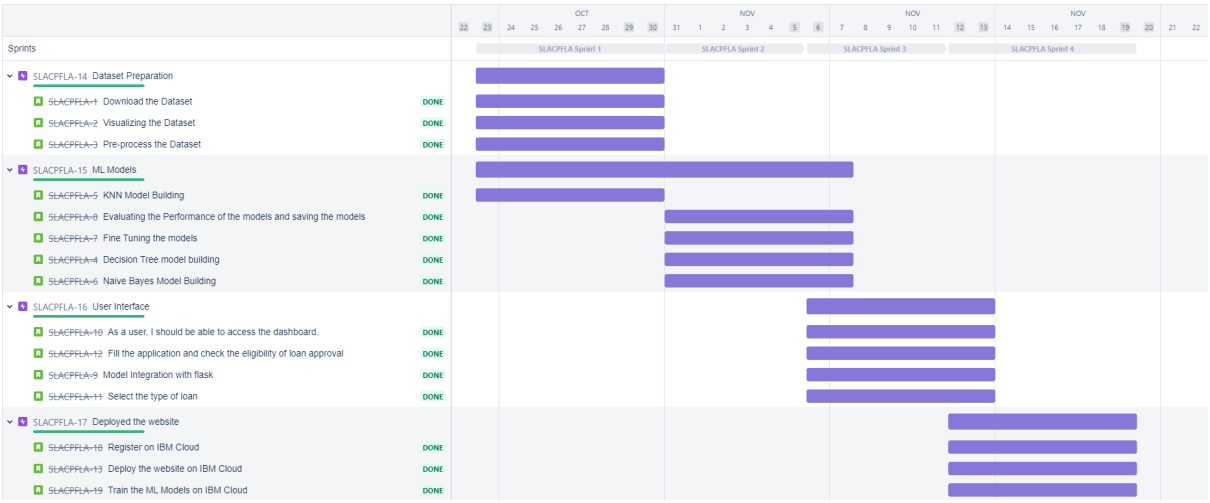

Figure 6.3 Sprint Monitoring

7. CODING & SOLUTIONING (Explain the features added in the project along with code)

-

7.1 LOAN ELIGIBILITY PREDICTION

```
from sklearn.model_selection import train_test_split
X_train,X_test,y_train,y_test =train_test_split(X_scaled,y, test_size=0.3,random_state=0)
```

KNEIGHBORS CLASSIFIER:

The k neighbors classification or KNN classification is a non-parametric algorithm where the model arrives at a distribution based on an assumed probability distribution. Here all parameters of the dataset and several latent parameters are used.

```
from sklearn.neighbors import KNeighborsClassifier
model =KNeighborsClassifier()
model.fit(X_train,y_train)
y_pred = model.predict(X_test)
y_pred1 = model.predict(X_train)
```

DECISION TREE:

A decision support tool known as a decision tree employs a tree-like model to represent options and their potential outcomes, including utility, resource costs, and chance event outcomes.

```
from sklearn import tree
from sklearn.tree import DecisionTreeClassifier
dtree = DecisionTreeClassifier()
dtree = dtree.fit(X_train, y_train)
y_predtree = dtree.predict(X_test)
y_pred1tree = dtree.predict(X_train)
```

GAUSSIAN NAIVE BAYES MODEL:

Gaussian Naive Bayes is a supervised algorithm that helps us to know the probability of the occurrence of an event given another event that had already occurred.

```
from sklearn.naive_bayes import GaussianNB
gnb = GaussianNB()
gnb.fit(X_train, y_train)
y_predNB = gnb.predict(X_test)
```

XGBOOST MODEL:

XGboost is a supervised algorithm for classification and regression. It is an ensembling technique that is an optimized gradient boosting algorithm through parallel processing, tree pruning, handling missing values, etc to avoid overfitting.bias.

```
import xgboost as xgb
from xgboost import XGBClassifier
from sklearn import model_selection
from sklearn.metrics import mean_squared_error
regressor = xgb.XGBRegressor(n_estimators=100, reg_lambda=1, gamma=0, max_depth=3)
regressor.fit(X_train, y_train)
```

```
y_predXG = regressor.predict(X_test)
```

7.2 MAXIMUM LOAN AMOUNT PREDICTION

If the loan gets rejected then the user can know the maximum loan amount.For predicting the loan amount Random Forest Regression is used.

RANDOM FOREST REGRESSION:

```
X_train,X_test,y_train,y_test=train_test_split(X_extract,Y_yes,test_size=0.3,
random_state=123)
X_train = np.array(X_train).reshape(-1,1)
y_train = np.array(y_train).reshape(-1,1)
X_test = np.array(X_test).reshape(-1,1)
y_test = np.array(y_test).reshape(-1,1)
rfreg=RandomForestRegressor()
rfreg.fit(X_train,y_train)
y_pred=rfreg.predict(X_test)
```

7.3 CHATBOT

We have built a chatbot where users can clarify their doubts on a loan taking process. Users can ask their questions and chatbot will reply with the answer. Chatbot is built using dialogflow.

8. TESTING

8.1 Test Cases

Test Scenario	Steps To Execute	Test Data	Expected Result
Verify user is able to see the Form screen when they open the URL.	Enter URL in any browser and click Enter.		Form for Loan approval prediction should be visible.
Verify the UI elements are displayed properly	1.Enter URL and click enter. 2.Check whether you		Application should be able to : a.click the radio

and the able to access all the fields in the form.	are able to click the radio buttons. 3.Check whether you are able to type in the input boxes. 4.Check whether you to press the buttons.		buttons (only one from eah group) b.should be able to type in the text box c.click the buttons
Verify user is able to correctly type the required inputs in the input fields.	1.Enter URL and click enter. 2.Click the radio button to select the gender. 3.Click the radio button to select the marital status. 4.Type in the number of dependents. 5.Click the radio button to select the education status. 6.Click the radio button to select the employment type. 7.Type in the income of applicant 8.Type in the co-applicant income 9.Type in the loan amount. 10.Type in the loan amount term. 11.Click the radio button to select the presence of credit history. 12.Click the radio button to select the property area.	Gender: Male Marital Status: Unmarried No of dependents: 0 Education : not Graduate Type of employment: not self employed Applicant income: 5849 Co-applicant income : 0 Loan amount : 128 Loan amount term : 360 Credit History : Yes Property area : Rural	User should able to: a) Select only one gender b) Select only one marital status c) Type in the number of dependents d) Select only one education status e) Select only one employment type f) Type in the applicant income g) Type in the co-applicant income h) Type in the loan amount i) Type in the loan amount term j) Select only one credit history field k) Select only one property area
Verify user is able to obtain the output after entering the inputs.	1.Enter URL and click enter. 2.Click the radio button to select the gender.	Gender: Male Marital Status: Unmarried No of dependents: 0 Education : not	Website should display "Your Application will be accepted".

	3.Click the radio button to select the marital status. 4.Type in the number of dependents. 5.Click the radio button to select the education status. 6.Click the radio button to select the employment type. 7.Type in the income of applicant 8.Type in the co-applicant income 9.Type in the loan amount. 10.Type in the loan amount term. 11.Click the radio button to select the presence of credit history. 12.Click the radio button to select the property area. 13.Click the Predict button	Graduate Type of employment: not self employed Applicant income: 5849 Co-applicant income : 0 Loan amount : 128 Loan amount term : 360 Credit History : Yes Property area : Rural	
Verify the visibility of chatbot when the user clicks the chatbot button.	1.Enter URL and click enter. 2.Click the chatbot button		Chatbot should we visible.
Verify the user able to interact with the chatbot.	1.Enter URL and click enter. 2.Click the chatbot button. 3.Enter the question.	Question: How do I get a Loan?	Answer: Make sure you know what documentation to bring with you. You will need your Identity proof, address proof and basic employment and income information to apply for a loan. Once they

			receive the application, they will determine if any additional information is required. With any lender, you'll need to verify your identity, provide your Aadhar number and Pan number, provide proof of income, and state the purpose for your loan.

Table 8.1 Test Cases

9. RESULTS

9.1 Performance Metrics

KNN model

	precision	recall	f1-score	support
0	0.78	0.49	0.60	51
1	0.83	0.95	0.89	134
accuracy			0.82	185
macro avg	0.81	0.72	0.74	185
weighted avg	0.82	0.82	0.81	185

Gaussian Naives Bayes model

	precision	recall	f1-score	support
0	0.91	0.41	0.57	51

1	0.81	0.99	0.89	134
accuracy			0.83	185
macro avg	0.86	0.70	0.73	185
weighted avg	0.84	0.83	0.80	185

XGBOOST model

	precision	recall	f1-score	support
0	0.79	0.45	0.58	51
1	0.82	0.96	0.88	134
accuracy			0.82	185
macro avg	0.81	0.70	0.73	185
weighted avg	0.81	0.82	0.80	185

Decision Tree model

	precision	recall	f1-score	support
0	0.48	0.57	0.52	51
1	0.82	0.77	0.80	134
accuracy			0.71	185
macro avg	0.65	0.67	0.66	185
weighted avg	0.73	0.71	0.72	185

10. ADVANTAGES & DISADVANTAGES

The proposed system has the following advantages:

1. This system eliminates the tiresome work of verifying the credibility of the borrower thereby saving the time of lenders.
2. The borrower can know the maximum amount he can borrow based on his current income.
3. The system produces accurate results as a result of ensembling the outputs from different models.
4. The website also has an integrated bot that helps the users to fill in the fields mentioned in the form.

The system also has a few disadvantages as follows,

1. The system has no means to check if the user input is authentic.
2. The system doesn't provide support to check for other types of loans.

11. CONCLUSION

The system provides a one-stop solution for lenders and borrowers. For lenders, this system eases their work by automating the process of verifying the credibility of the user. The borrowers can use the website to know the maximum amount of loan they can obtain based on their current income.

12. FUTURE SCOPE

The website can be extended to include other types of loans like vehicle loans, short-term business loans, etc. Ways to check for the authenticity of the user details can be included.

13. APPENDIX

SOURCE CODE:

FLASK:

```
from flask import Flask, render_template, request
```

```
import requests
import pickle
import numpy as np
import pandas as pd

API_KEY = "3Pexm294mcuQRhjEJIBP6NRXfKfO713c9XnZM6UP4XoH"

token_response = requests.post('https://iam.cloud.ibm.com/identity/token', data={"apikey":
                                                                API_KEY, "grant_type":
    'urn:ibm:params:oauth:grant-type:apikey'})
mltoken = token_response.json()["access_token"]

header = {'Content-Type': 'application/json',
          'Authorization': 'Bearer ' + mltoken}



app = Flask(__name__)

rgressor = pickle.load(open(
   r'E:\Sem7\ibm\Sprint3\smart_lender\pickles\randomforestregressor.pkl', 'rb'))



@app.route('/')
def start():
   return render_template('index.html')



@app.route('/predict', methods=['POST', 'GET'])
def predict():
```

```
if request.method == "POST":
    inputParameters = [int(x) for x in request.form.values()]
    print("Applicant Income {}".format(inputParameters[5]))
    print("Input parameters")
    print(inputParameters)  # type - list

    inputParameters[5] = float(inputParameters[5])
    inputParameters[6] = float(inputParameters[6])

    inputList = [inputParameters]

# NOTE: manually define and pass the array(s) of values to be scored in the next line
        payload_scoring = {"input_data": [{"fields": [["Gender", "Married", "Dependents",
  "Education", "Self_Employed", "ApplicantIncome",
                                                      "CoapplicantIncome", "LoanAmount",
  "Loan_Amount_Term", "Credit_History", "Property_Area"]], "values": inputList}]}

                                                                response_scoring =
  requests.post('https://eu-gb.ml.cloud.ibm.com/ml/v4/deployments/e1d22aab-8a1c-4758-8
  3f4-9e7ee678f21f/predictions?version=2022-11-19', json=payload_scoring,
                                headers={'Authorization': 'Bearer ' + mltoken})
    print("Scoring response")
    print(response_scoring.json())
    prediction = response_scoring.json()["predictions"][0]["values"][0][0]
    print(prediction)

    loan = rgressor.predict(np.array(inputParameters[5]).reshape(1, -1))

    op_rgr = int(loan[0])

    if (prediction == 'Y'):
```

```
            output = "Your loan will be approved"
        else:
            output = "For this amount, your loan might not be approved. \nIf you apply " + \
                str(op_rgr) + ", your loan will be approved."
        return render_template('index.html', prediction_text=output)

    else:
        return render_template("index.html")


if __name__ == "__main__":
    app.run(debug=True)
```

WEBSITE:

```
<!DOCTYPE html>
<html lang="en" dir="ltr">

<head>
    <meta charset="utf-8">
    <meta name="viewport" content="width=device-width, initial-scale=1">
    <link rel="stylesheet" href="static/style.css">
                                                    <link rel="stylesheet"
     href="https://maxcdn.bootstrapcdn.com/bootstrap/3.4.1/css/bootstrap.min.css">
    <!-- <link rel="stylesheet"

     href="https://cdn.jsdelivr.net/npm/@fortawesome/fontawesome-free@6.2.0/css/fontawes
     ome.min.css"

     integrity="sha384-z4tVnCr80ZcL0iufVdGQSUzNvJsKjEtqYZjiQrrYKlpGow+btDHDf
     QWkFjoaz/Zr" crossorigin="anonymous"> -->
```

```
<script src="https://ajax.googleapis.com/ajax/libs/jquery/3.6.0/jquery.min.js"></script>
                                                                                <script
 src="https://maxcdn.bootstrapcdn.com/bootstrap/3.4.1/js/bootstrap.min.js"></script>
                                                                <link                rel="stylesheet"
 href="http://netdna.bootstrapcdn.com/font-awesome/4.0.3/css/font-awesome.min.css">
      <link   href="https://cdn.jsdelivr.net/npm/bootstrap@5.1.3/dist/css/bootstrap.min.css"
 rel="stylesheet"

 integrity="sha384-1BmE4kWBq78iYhFldvKuhfTAU6auU8tT94WrHftjDbrCEXSU1oBo
 qyl2QvZ6jIW3" crossorigin="anonymous">
<script src="//code.jquery.com/jquery-1.11.1.min.js"></script>
<script>
   $(document).ready(function () {
      $(".Layout").toggle();
      $(".chat_off").toggle();

      $(".chat_on").click(function () {
         $(".Layout").toggle();
         $(".chat_on").toggle();
         $(".chat_off").toggle();
      });

      $(".chat_off").click(function () {
         $(".Layout").toggle();
         $("chat_off").toggle();
         $(".chat_on").toggle();
      });
   });
</script>
<title>loan app</title>
<style>
```

```
        body {
            background-image: url('static/pig.gif');
            background-repeat: no-repeat;
            background-attachment: fixed;
            background-size: 100% 100%;
        }
    </style>
</head>

<body>


    <div class="container main">
        <div class="container col-md-8">
            <br>

            <br>
            <br>
            <center>
                    <h1 class='main_heading text-light' style="font-size : 5em;"> Loan Approval
    Prediction Model</h1>
            </center>
            <br><br>
                <form class="well form-horizontal opacity-75" action="/predict" method="post"
    id="contact_form"
                style="font-size : 2em;">
                <!-- GENDER -->
                <div class="form-group">
                    <label class="col-md-4 control-label">Gender</label>
                    <div class="col-md-4">
                        <div class="radio">
```

```
                <label>
                    <input type="radio" name="gender1" id="gender1" value="1" /> Male
                </label>
            </div>
            <div class="radio">
                <label>
                    <input type="radio" name="gender1" id="gender1" value="0" /> Female
                </label>
            </div>
        </div>
    </div>
    <!-- MARRIED -->
    <div class="form-group">
        <label class="col-md-4 control-label">Marital Status</label>
        <div class="col-md-4">
            <div class="radio">
                <label>
                        <input type="radio" name="marital_status1" id="marital_status1"
value="1" /> Married
                </label>
            </div>
            <div class="radio">
                <label>
                        <input type="radio" name="marital_status1" id="marital_status1"
value="0" /> Unmarried
                </label>
            </div>
        </div>
    </div>

    <!-- DEPENDENTS -->
```

```
        <div class="form-group opacity-100">
            <div class="col-sm-10">
                        <input style="font-size: 1em;" class="form-control form-control-lg"
type="text"
                                    name="dependents" placeholder="Number of dependents"
required="required" />
            </div>
        </div>
        <!-- EDUCATION -->
        <div class="form-group">
            <label class="col-md-4 control-label">Education status</label>
            <div class="col-md-4">
                <div class="radio">
                    <label>
                        <input type="radio" name="education_status1" id="education_status1"
value="1" />
                        Graduate
                    </label>
                </div>
                <div class="radio">
                    <label>
                        <input type="radio" name="education_status1" id="education_status1"
value="0" /> not
                        Graduate
                    </label>
                </div>
            </div>
        </div>

        <!-- SELF EMPLOYED -->
        <div class="form-group">
```

```
            <label class="col-md-4 control-label">Are you self-employed?</label>
            <div class="col-md-4">
              <div class="radio">
                <label>
                        <input type="radio" name="self_employed1" id="self_employed1"
value="1" />Yes
                </label>
              </div>
              <div class="radio">
                <label>
                        <input type="radio" name="self_employed1" id="self_employed1"
value="0" /> No
                </label>
              </div>
            </div>
          </div>


          <!-- APPLICANT INCOME -->
          <div class="form-group">
            <div class="col-sm-10">
                        <input style="font-size: 1em;" class="form-control form-control-lg"
type="text"
                 name="ApplicantIncome" placeholder="Your Income" required="required"
/>
            </div>
          </div>
          <!-- COAPPLICANT INCOME -->
          <div class="form-group">
            <div class="col-sm-10">
```

```
                    <input style="font-size: 1em;" class="form-control form-control-lg"
type="text"
                        name="CoapplicantIncome" placeholder="Co-applicant Income"
required="required" />
            </div>
        </div>
        <!-- LOAN AMOUNT -->
        <div class="form-group">
            <div class="col-sm-10">
                    <input style="font-size: 1em;" class="form-control form-control-lg"
type="text"
                name="LoanAmount" placeholder="Loan Amount" required="required" />
            </div>
        </div>

        <!-- LOAN AMOUNT TERM  -->
        <div class="form-group">
            <div class="col-sm-10">
                                    <!-- <select class="form-control" type="number"
name="Loan_Amount_Term" required="required">
                <option value="0">loan term:</option>
                <option value="240">6 months</option>
                <option value="360">12 months</option>
            </select> -->
                    <input style="font-size: 1em;" class="form-control form-control-lg"
type="text"
                     name="Loan_Amount_Term" placeholder="Loan Amount Term (in
months)" required="required" />
            </div>
        </div>
        <!-- CREDIT HISTORY -->
```

```
        <div class="form-group">
            <label class="col-md-4 control-label">Do you have credit history?</label>
            <div class="col-md-4">
                <div class="radio">
                    <label>
                            <input type="radio" name="credit_history1" id="credit_history1"
value="1" />Yes
                    </label>
                </div>
                <div class="radio">
                    <label>
                            <input type="radio" name="credit_history1" id="credit_history1"
value="0" /> No
                    </label>
                </div>
            </div>
        </div>

        <!-- PROPERTY -->

        <div class="form-group">
            <label class="col-md-4 control-label">Property Area</label>
            <div class="col-md-4">
                <div class="radio">
                    <label>
                            <input type="radio" name="property_area1" id="property_area1"
value="2" />Urban
                    </label>
                </div>
                <div class="radio">
```

```
                <label>
                        <input type="radio" name="property_area1" id="property_area1"
value="1" /> Semiurban
                </label>
              </div>
              <div class="radio">
                <label>
                <input type="radio" name="property_area1" id="property_area1" value="0"
/> Rural
                </label>
              </div>
            </div>
          </div>


          <div class="form-group">
            <div class="col-md-4"></div>
            <div class="col-md-3 btn btn-primary btn-lg">
       <button type="submit" class="button btn btn-default text-light">PREDICT</button>
            </div>
          </div>
        </form>

        <center>
          <b>
            <div class="card bg-warning">
              <div class="card-body">
                <h2 style="color:#FF0000" ;>{{ prediction_text}}</h2>
              </div>
            </div>
```

```
            </b>
          </center>



          <h2 class="result"></h2>
        </div>

        <div class="d-flex justify-content-end col-md-4">

          <iframe allow="microphone;" width="350" height="430"

        src="https://console.dialogflow.com/api-client/demo/embedded/1723de40-cd89-4826-a0
        d9-926be1623da7"
              class="Layout">
          </iframe>
        </div>
        <div class="chat_on">
        <span class="chat_on_icon"><i class="fa fa-comments" aria-hidden="true"></i></span>
        </div>
        <div class="chat_off">
        <span class="chat_off_icon">
        <i class="fa fa-comments" aria-hidden="true"></i></span>
        </div>
      </div>

    </body>

    </html>
```

GITHUB LINK:

https://github.com/IBM-EPBL/IBM-Project-4455-1658732829

PROJECT DEMO LINK:

https://drive.google.com/file/d/1ITZ0uCq11Cm8dqnbgp-aPwXyytVTpiIV/view?usp=sharing

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